DETAILED ACTION

Status of Application

Claims 1-29 are pending and presented for examination.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-5, 8-12, and 23 rejected under 35 U.S.C. 102(b) as being anticipated by Ellens et al. (US2003/0094893).

Claim 1 is drawn to a oxynitride fluorescent material having a JEM phase represented by the formula $MAl(Si_{6-z}Al_z)N_{10-z}O_z$ wherein M is one or more elements selected from the group consisting of La, Ce, Pr, ND, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu. Claim 2 further requires a JEM phase as a mother crystal with M1 as a luminescence center.

Ellens et al. (hereafter, Ellens) teaches fluorescent oxynitride materials having the formula $MSi_5Al_2ON_9$ which is equivalent to the "JEM" phase compositional formula required by Claim 1, and wherein M is at least one selected from Ba, Ca, Sr, Lu, La, Gd, and Y and where a dopant D selected from Eu and Ce partially replaces M cation sites (see [0005], [0009] and [0011]). In regards to mother crystal and luminescence center requirements, these

properties are inherent to the oxynitride fluorescent material described here. The JEM phase represents the main crystalline phase and M as well as D function as a luminescence center.

In regards to claims 3 and 4, Ellens teaches a specific example of $LaSi_5Al_2ON_9:Ce^{3+}$ (see [0053]).

In regards to claim 5, Ellens teaches the fluorescent material to be doped with Eu or Ce (see rejection of claim 1 above). Although the reference does not teach a specific example of a JEM phase material containing Eu, it teaches a very specific genus containing only Eu and Ce cation dopants and one of ordinary skill in the art would envisage each of the species. The reference therefore anticipates the fluorescent material containing at least Eu as required by claim 5.

Claim 8 is drawn to a oxynitride fluorescent material having a compositional formula $M_aSi_bAl_cO_dN_e$ wherein M is one or more elements selected from La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu and meeting certain conditions. Claim 9 further requires f=g=h=i=1. Claim 10 further requires z=1.

In regards to claims 8-10, Ellens teaches a fluorescent material having the formula $MSi_5Al_2ON_9$ which satisfies the conditions required by claim 8, such that a=1, b=5, c=2, d=1, e=9, z=1, and f=g=h=i=1 wherein M is at least one selected from Ba, Ca, Sr, Lu, La, Gd, and Y and where a dopant D selected from Eu and Ce partially replaces M cation sites (see [0005], [0009] and [0011]).

In regards to claims 11 and 12, Ellens teaches a specific example of $LaSi_5Al_2ON_9:Ce^{3+}$ (see [0053]).

In regards to claim 23, Ellens teaches an illumination unit having at least one LED as a light source and containing the fluorescent material as required by claim 1 (see [0004], [0005], and [0008]).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 6-7, 13-15,16-21, and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ellens et al. (US2003/0094893) as applied to claims 1-5, 8-12, 16, and 23 above.

Claims 6 and 7 further require the fluorescent material of claim 3 to include at least Tb and at least Tb and Ce respectively. Ellens teaches that for Ce doped materials up to 30% of the Ce dopant may be replaced with Pr or Tb (see [0061]). Thus, it would have been obvious to one of ordinary skill in the art to select from the teachings of Ellens a fluorescent material containing La, Ce and Tb as required by claim 7. One would have been motivated to do so in order to facilitate the transfer of energy (see [0061]) and to increase the industrial applicability of the material.

In regards to claim 13-15, Ellens teaches where M is at least one selected from Ba, Ca, Sr, Lu, La, Gd, and Y and where a dopant D selected from Eu and Ce, Ellens further teaches that up to 30% of a Ce dopant may be replaced with Tb (see rejection of claims 3 and 6 above). Although the reference does not provide a specific example including La and Eu (re. claim 13), La and Tb (re. claim 14) or La, Ce and Tb (re. claim 15) together, it would have been obvious to one of ordinary skill in the art to choose from the disclosed genus to make such combinations. One of ordinary skill in the art would have a reasonable expectation of success with the predictable result of a better oxynitride fluorescent material.

In regards to claims 16-19, Ellens teaches a fluorescent material containing at least La and Ce (see rejection of claim 12 above) and teaches the combinations of La and Eu, La and Tb, and La, Ce, and Tb (see rejection of claims 13-15 above). The reference further teaches that the proportion of the

dopant (Eu or Ce) to replace the cation M (in this case La) should be 0.5-15% equivalent to $0.005 \leq Ce/La \leq 0.15$ when Ce is the dopant and $0.005 \leq Eu/La \leq 0.15$ when Eu is the dopant material (see [0058]). Ellens teaches that up to 30% of a Ce dopant may be replaced with Tb (see rejection of claim 6 above), which would correspond to ratios of $0.0015 \leq Tb/La \leq 0.05$ and $0.005 \leq (Ce+Tb)/La \leq 0.15$ respectively. It would have been obvious to one of ordinary skill in the art to choose from the overlapping ranges taught by Ellens. One would be motivated to do so in order to produce a material with accurately selected emission wavelength and to optimize the light efficiency (see [0058]).

In regards to claims 20-21, Ellens teaches maximum emission wavelengths in the blue range (430-470 nm), green (495-540), and red (540-620 nm)(see Ellens claim 8). The reference differs in that it does not disclose the specific ranges of maximum emission and excitation wavelengths. However, Ellens teaches emission wavelength is a result effective variable and can be shifted by altering dopant concentration (see [0058] and [0064]). It would have been obvious to one of ordinary skill in the art at the time the invention was made to choose the instantly claimed ranges through process optimization, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See *In re Boesch*, 205 USPQ 215. Likewise, the maximum excitation wavelength ranges would be a result effective variable, which correspond to the particular composition of the fluorescent material, and it would have been

obvious to one of ordinary skill in the art to optimize the dopant composition to reach excitation wavelengths in the instantly claimed ranges. One would have been motivated to do so in order to obtain the best results from the fluorescent material and maximize industrial applicability of the invention.

In regards to claims 24-25, Ellens teaches an illumination unit (equivalent to a lighting device) using a LED as an emission light source having a wavelength of 300-570 nm (see Ellens claim 1) and said illumination unit wherein to generate white light, primary radiation is emitted at 360-420 nm and exposed to at least three phosphors(equivalent to fluorescent materials) having maximum emission wavelengths in the blue range (430-470 nm), green (495-540), and red (540-620 nm)(see Ellens claim 9). It would have been obvious to one of ordinary skill in the art to choose from the portion of the overlapping ranges, with the predictable result of success. One would have been motivated to do so to achieve a white light with good color rendering (see [0007]).

In regards to claim 26, Ellens teaches an illumination unit wherein to generate white light, primary radiation is emitted at 360-420 nm and exposed to at least three phosphors(equivalent to fluorescent materials) having maximum emission wavelengths in the blue range (430-470 nm), green (495-540), and red (540-620 nm) (see Ellens claim 9). The reference differs in that it does not teach the specific combination of the fluorescent material and a yellow fluorescent material which emits light having a wavelength of 550-600 nm. However, the illumination unit taught by Ellens inherently includes the required yellow

wavelength range of 550-600 nm (disclosed by Ellens as a red wavelength range). Furthermore, the reference teaches the combination of yellow and blue fluorescent materials to produce white light is well known in the art (see [0002]). Therefore it would have been obvious to one of ordinary skill in the art to select from the ranges taught by Ellens, a yellow fluorescent material emitting light with a wavelength of 550-600 nm from the lower end of the “red” 540-620 nm range taught by Ellens. One would have been motivated to make such a modification in order to produce a better white lighting unit with greater stability and to increase the industrial applicability of the product.

In regards to claims 28-29, Ellens teaches fluorescent oxynitride materials having the formula $MSi_5Al_2ON_9$ which is equivalent to the “JEM” phase compositional formula required by Claim 1, and wherein M is at least one selected from Ba, Ca, Sr, Lu, La, Gd, and Y and where a dopant D selected from Eu and Ce partially replaces M cation sites (see [0005], [0009] and [0011]). The reference further teaches the fluorescent materials are useful as pigments and phosphors particularly applicable to displays, lamps, or LEDs (see [0059]). The VFD, FED, PDP, and CRT displays required by claim 29 are well known in the art to employ phosphor materials. Therefore, it would have been obvious to one of ordinary skill in the art to use the fluorescent oxynitride material taught by Ellens in a display such as a PDP or CRT. One would have a reasonable expectation of success and would be motivated to do so in order to maximize the industrial applicability of the fluorescent material.

6. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ellens et al. (US2003/0094893) as applied to claim 1 above, in view of Xie et al. ("Photoluminescence of Cerium-Doped alpha-SiAlON Materials" J. Am. Ceram. Soc.,87 (7) 1368-1370, July 2004).

Claim 22 further requires a mixture of said JEM phase material and another crystal or amorphous phase, wherein said mixture has a JEM content of 50% by mass or greater. Ellens teaches a JEM phase material but differs in that it does not teach a mixture of a JEM phase and another crystal or amorphous phase. Xie et al. teaches a mixture of beta-SiAlON and a JEM phase, and also a mixture of beta-SiAlON, alpha-SiAlON, and a JEM phase (see page 1369, left column). It would have been obvious to one of ordinary skill in the art to modify the JEM phase based fluorescent material of Ellens with the multiphase material of Xie to form a material with over 50% by mass JEM phase and an additional crystal phase. One would have been motivated to make such a modification in order to enhance long-wavelength light emissions (see Xie page 1368, right column) with a predictable result of success.

7. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ellens et al. (US2003/0094893) as applied to claims 1, 23, and 26 above, in view of Mitomo et al. (US2003/0168643).

Claim 27 dependent on claim 26, further requires the yellow fluorescent material to be a Ca-alpha-Sialon with Eu in the form of a solid solution. Ellens

teaches the use of yellow phosphors (see rejection of claim 26 above) and sialon fluorescent materials (see [0008]) but does not teach the specific use of Ca-alpha-Sialon as a yellow phosphor. However it would have been obvious to one of ordinary skill in the art to modify the illumination unit of Ellens with the oxynitride phosphor taught by Mitomo et al. to produce a lighting device with a yellow phosphor of Ca-alpha-Sialon:Eu. Mitomo et al. teaches a Ca-alpha-Sialon solid solution containing Eu (see Mitomo abstract) and further teaches a white LED can be produced by using the disclosed yellow phosphor in combination with a blue emitting LED (see Mitomo [0005]). While Mitomo does not disclose the specific wavelength of light emitted from the Ca-alpha-Sialon it would have been obvious to one of ordinary skill in the art to choose between the required 550-600 nm which includes the intrinsic wavelength range of yellow visible light. One would have been motivated to make such a modification in order to produce a lighting device with superior reliability and stability (see Mitomo [0005]).

Double Patenting

8. Claim 12 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 11/360373. Although the conflicting claims are not identical, they are not patentably distinct from each other because each is drawn to an oxynitride fluorescent material having a compositional formula of $MSi_bAl_cO_dN_e$ wherein M=LaCe and satisfies the same compositional conditions. Although the instant claim 12 does not specifically require an

another sub-component in addition to La, it states that M contains at least La and Ce and therefore it would have been obvious to one of ordinary skill in the art to add an additional sub-component to the composition of M selected from Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu taught as components by the instant claim 8 and required by copending claim 1.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Conclusion

All claims have been rejected. No claims have been allowed.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Ellens et al. (US6670748) which corresponds to the patent of prior cited application Ellens et al. (US2003/0094893).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHN A. HEVEY whose telephone number is (571)270-3594. The examiner can normally be reached on Monday - Friday 7:30 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on 571-270-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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/Vickie Kim/

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